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PHARMACEUTICAL/TOXICOLOGY

Towards a spatiotemporally explicit toxicokinetic-toxicodynamic model for earthworm toxicity

2020-03-05

The aim of the environmental risk assessment of chemicals is the prevention of unacceptable adverse effects on the environment. Therefore, the risk assessment for in-soil organisms, such as earthworms, is based on two key elements: the exposure assessment and the effect assessment. In the current risk assessment scheme, these two elements are not linked. While for the exposure assessment, advanced exposure models can take the spatial and temporal scale of substances into account, the effect assessment in the lower tiers considers only a limited temporal and spatial variability. However, for soil organisms, such as earthworms, those scales play a significant role as species move through the soil in response to environmental factors. To overcome this gap, we propose a conceptual integration of pesticide exposure, ecology, and toxicological effects on earthworms using a modular modeling approach. An essential part of this modular approach is the environment module, which utilizes exposure models to provide spatially and temporally explicit information on environmental variables (e.g., temperature, moisture, organic matter content) and chemical concentrations. The behavior module uses this information and simulates the feeding and movement of different earthworm species using a trait-based approach. The resulting exposure can be processed by a toxicokinetic-toxicodynamic (TKTD) module. TKTD models are particularly suitable to make effect predictions for time-variable exposure situations as they include the processes of uptake, elimination, internal distribution, and biotransformation of chemicals and link the internal concentration to an effect at the organism level. The population module incorporates existing population models of different earthworm species. The modular approach is illustrated using a case study with an insecticide. Our results emphasize that using a modular model approach will facilitate the integration of exposure and effects and thus enhance the risk assessment of soil organisms.~sAuthors: Roeben V, Oberdoerster S, Rakel KJ, Liesy D, Capowiez Y, Ernst G, Preuss TG, Gergs A, Oberdoerster C

Full Source: The science of the total environment. 2020 Mar 5;722:137673. doi: 10.1016/j.scitotenv.2020.137673. [Epub ahead of print]

To overcome this gap, we propose a conceptual integration of pesticide exposure, ecology, and toxicological effects on earthworms using a modular modeling approach.

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Nickel-Induced Developmental Neurotoxicity in *C. elegans* Includes Cholinergic, Dopaminergic and GABAergic Degeneration, Altered Behaviour, and Increased SKN-1 Activity.

2020-02-08

Nickel (Ni) is a ubiquitous metal in the environment with increasing industrial application. While environmental and occupational exposure to Ni compounds has been known to result in toxicities to several organs, including the liver, kidney, lungs, skin and gonads, neurotoxic effects have not been extensively investigated. In this present study, we investigated specific neuronal susceptibility in a *C. elegans* model of acute Ni neurotoxicity. Wild-type worms and worms expressing green fluorescent protein (GFP) in either cholinergic, dopaminergic or GABAergic neurons were treated with NiCl₂ for 1 h at the first larval (L1) stage. The median lethal dose (LD₅₀) was calculated to be 5.88 mM in this paradigm. Morphology studies of GFP-expressing worms showed significantly increasing degeneration of cholinergic, dopaminergic and GABAergic neurons with increasing Ni concentration. Significant functional changes in locomotion and basal slowing response assays reflected that cholinergic and dopaminergic neuronal function, respectively, were impaired due to Ni treatment. Interestingly, a small but significant number of worms exhibited shrinker phenotype upon Ni exposure but no loopy head foraging behaviour was observed suggesting that function of D-type GABAergic neurons of *C. elegans* may be specifically attenuated while the RME subset of GABAergic neurons are not. GFP expression due to induction of glutathione S-transferase 4 (*gst-4*), a target of Nrf2 homolog *skn-1*, was increased in a P_{*gst-4*}::GFP worm highlighting Ni-induced oxidative stress. RT-qPCR verified upregulation of this expression of *gst-4* immediately after exposure. These data suggest that oxidative stress is associated with neuronal damage and altered behaviour due to developmental Ni exposure.

Authors: Ijomone OM, Miah MR, Akingbade GT, Bucinca H, Aschner M
Full Source: Neurotoxicity Research.2020 Apr;37(4):1018-1028. doi: 10.1007/s12640-020-00175-3. Epub 2020 Feb 8.

Arsenic Toxicity: Molecular Targets and Therapeutic Agents

2020-02-04

High arsenic (As) levels in food and drinking water, or under some occupational conditions, can precipitate chronic toxicity and in some cases cancer. Millions of people are exposed to unacceptable amounts of As

In this present study, we investigated specific neuronal susceptibility in a *C. elegans* model of acute Ni neurotoxicity.

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through drinking water and food. Highly exposed individuals may develop acute, subacute, or chronic signs of poisoning, characterized by skin lesions, cardiovascular symptoms, and in some cases, multi-organ failure. Inorganic arsenite(III) and organic arsenicals with the general formula R-As²⁺ are bound tightly to thiol groups, particularly to vicinal dithiols such as dihydrolipoic acid (DHLA), which together with some seleno-enzymes constitute vulnerable targets for the toxic action of As. In addition, R-As²⁺-compounds have even higher affinity to selenol groups, e.g., in thioredoxin reductase that also possesses a thiol group vicinal to the selenol. Inhibition of this and other ROS scavenging seleno-enzymes explain the oxidative stress associated with arsenic poisoning. The development of chelating agents, such as the dithiols BAL (dimercaptopropanol), DMPS (dimercaptopropanesulfonate) and DMSA (dimercaptosuccinic acid), took advantage of the fact that As had high affinity towards vicinal dithiols. Primary prevention by reducing exposure of the millions of people exposed to unacceptable As levels should be the prioritized strategy. However, in acute and subacute and even some cases with chronic As poisonings chelation treatment with therapeutic dithiols, in particular DMPS appears promising as regards alleviation of symptoms. In acute cases, initial treatment with BAL combined with DMPS should be considered.

Authors: Nurchi VM, Djordjevic AB, Crisponi G, Alexander J, Bjørklund G, Aaseth J
Full Source: Biomolecules. 2020 Feb 4;10(2). pii: E235. doi: 10.3390/biom10020235.

Optimization of Gas Chromatography-electron Ionization-tandem Mass Spectrometry for Determining Toxic Non-ortho Polychlorinated Biphenyls in Breast Milk.

2019-12-05

BACKGROUND:

A needle trap device (NTD) was packed with Carbotrap/silica composite sorbent and applied for field sampling of halogenated volatile organic compounds (HVOCs) followed by gas chromatography/mass spectrometry (GC/MS) separation and determination.

METHODS:

Carbotrap B, as a highly pure surface sorbent, was prepared using sol-gel method to improve its surface properties for adsorption/desorption of the target analytes. The effects of important experimental variables on the sampling and determination of trichloroethylene (thrCE) and tetrachloroethylene (tetCE) using the proposed NTD-GC/MS strategy were evaluated and optimized.

The carryover experiments showed that the carryover effect disappeared after 3 min of desorption time.

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RESULTS:

The results showed that sampling temperature and relative humidity interfered with sampling efficiency of the developed method and peak area responses of the analytes decreased with increasing temperature and relative humidity. The peak areas of the analytes increased with raising desorption temperature from 180 to 250 °C, and increasing desorption time from 1 to 3 min. The carryover experiments showed that the carryover effect disappeared after 3 min of desorption time. The Limits of Detection (LODs) and Limits of Quantitation (LOQs) of the analytes were in the range 0.01-0.03 and 0.05-0.09, respectively.

CONCLUSIONS:

The results indicated that the developed NTD-GC/MS procedure can be used as a technology with high sensitivity for the field sampling and determination of HVOCs.

Authors: Poormohammadi A, Bahrami A, Ghiasvand A, Shahna FG, Farhadian M

Full Source: Journal of environmental health, science and engineering. 2019 Dec 5;17(2):1045-1053. doi: 10.1007/s40201-019-00418-2. eCollection 2019 Dec.

The additive effects of hydroxychloroquine to maintenance therapy with standard of care in patients with systemic lupus erythematosus.

2020-02-05

AIM:

In this retrospective study, the effect of hydroxychloroquine (HCQ) added to maintenance therapy according to the standard of care (SoC) was evaluated for 1 year in 101 patients with systemic lupus erythematosus (SLE).

METHODS:

The primary endpoint was the SLE Disease Activity Index (SLEDAI). The secondary endpoints were the British Isles Lupus Assessment Group index, serum complement activity (CH50) levels, anti-double-stranded DNA (dsDNA) antibody titer, concomitant corticosteroid (CS) dose, and Systemic Lupus International Collaborating Clinics (SLICC) damage index. These variables were compared between the SoC + HCQ (n = 42) and SoC (n = 59) groups.

RESULTS:

The SLEDAI improved from 2 (0, 6) to 0 (0, 4) in the SoC + HCQ group (P = .038) but significantly deteriorated from 1 (0, 4) to 2 (0, 8) in the SoC group (P = .033). CH50, anti-dsDNA antibody titer, concomitant CS dose,

The primary endpoint was the SLE Disease Activity Index (SLEDAI).

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and SLICC damage index did not significantly change. The increase in the SLEDAI and concomitant CS dose after 1 year were all significantly greater in the SoC group, and the proportion of patients with SLEDAI flare was significantly lower in the SoC + HCQ group (SoC + HCQ: 4.76% vs SoC: 25.4%, P = .006). Univariate logistic regression analyses identified HCQ as a predictive factor for no SLEDAI flare (P = .003, odds ratio 6.81, 95% confidence interval 1.77-45.00).

CONCLUSIONS:

The use of HCQ effectively improved SLEDAI scores and was a predictive factor for the prevention of SLEDAI flare. Therefore, HCQ may be considered a potential mainstay of maintenance therapy.

Authors: Miyagawa I, Nakano K, Nakayamada S, Iwata S, Hanami K, Fukuyo S, Kubo S, Kawabe A, Miyazaki Y, Inoue Y, Ueno M, Ohkubo N, Fujita Y, Tanaka Y

Full Source: International journal of rheumatic diseases. 2020 Feb 5. doi: 10.1111/1756-185X.13792. [Epub ahead of print]

CHEMICAL EFFECTS

Differential responses of gut microbiota of male and female fathead minnow (*Pimephales promelas*) to a short-term environmentally-relevant, aqueous exposure to benzo[a]pyrene

2020-03-12

In addition to aiding in digestion of food and uptake of nutrients, microbiota in guts of vertebrates are responsible for regulating several beneficial functions, including development of an organism and maintaining homeostasis. However, little is known about effects of exposures to chemicals on structure and function of gut microbiota of fishes. To assess effects of exposure to polycyclic aromatic hydrocarbons (PAHs) on gut microbiota, male and female fathead minnows (*Pimephales promelas*) were exposed to environmentally-relevant concentrations of the legacy PAH benzo[a]pyrene (BaP) in water. Measured concentrations of BaP ranged from 2.3×10^{-3} to $1.3 \mu\text{g L}^{-1}$. The community of microbiota in the gut were assessed by use of 16S rRNA metagenetics. Exposure to environmentally-relevant aqueous concentrations of BaP did not alter expression levels of mRNA for *cyp1a1*, a "classic" biomarker of exposure to BaP, but resulted in shifts in relative compositions of gut microbiota in females rather than males. Results presented here illustrate that in addition to effects on more well-studied molecular endpoints, relative

However, little is known about effects of exposures to chemicals on structure and function of gut microbiota of fishes.

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compositions of the microbiota in guts of fish can also quickly respond to exposure to chemicals, which can provide additional mechanisms for adverse effects on individuals.

Authors: DeBofsky A, Xie Y, Grimard C, Alcaraz AJ, Brinkmann M, Hecker M, Giesy JP

Full Source: Chemosphere. 2020 Mar 12;252:126461. doi: 10.1016/j.chemosphere.2020.126461. [Epub ahead of print]

Ferrate(VI) pretreatment before disinfection: An effective approach to controlling unsaturated and aromatic halo-disinfection byproducts in chlorinated and chloraminated drinking waters

2020-03-20

Disinfection is an essential process of drinking water treatment to eliminate harmful pathogens, but it generates potentially toxic disinfection byproducts (DBPs). Ferrate (FeO_4^{2-} , Fe(VI)) was used to pre-oxidize natural organic matter (NOM, the precursor of DBPs) in source water to control DBP formation in subsequent chlorine or chloramine disinfection. Currently, it is unclear how Fe(VI) changes the structure of NOM, and no information details the effect of Fe(VI) pretreatment on the aromatic DBPs or the speciation of overall DBPs generated in subsequent disinfection of drinking water. In the present paper, Fe(VI) was applied to pretreat simulated source water samples at a Fe(VI) to dissolved organic carbon mole ratio of 1:1 at pH 8.0. ^{13}C nuclear magnetic resonance spectroscopy was newly employed to characterize NOM in simulated source waters with and without Fe(VI) treatment, and it was demonstrated that Fe(VI) converted unsaturated aromatic C functional groups in NOM to saturated aliphatic ones. High-resolution mass spectrometry (HRMS) and high performance liquid chromatography/triple quadrupole MS were applied to analyze the DBPs generated in chlorination and chloramination of the source waters with and without Fe(VI) pretreatment. It was confirmed that Fe(VI) pretreatment followed by chlorination (or chloramination), generated DBPs containing less unsaturated, halogenated, and aromatic moieties than chlorination (or chloramination) without pretreatment by Fe(VI). Finally, the cytotoxicity of disinfected drinking water samples were assessed with the human epithelial colorectal adenocarcinoma Caco-2 cell line (a model of the intestinal barrier for ingested toxicants), and the results show that Fe(VI)

Ferrate (FeO_4^{2-} , Fe(VI)) was used to pre-oxidize natural organic matter (NOM, the precursor of DBPs) in source water to control DBP formation in subsequent chlorine or chloramine disinfection.

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pretreatment detoxified the chlorinated and chloraminated drinking waters.

Authors: Liu J, Lujan H, Dhungana B, Hockaday WC, Sayes CM, Cobb CP, Sharma VK

Full Source: Environment international. 2020 May;138:105641. doi: 10.1016/j.envint.2020.105641. Epub 2020 Mar 20.

Glove permeation of chemicals: The state of the art of current practice-Part 2. Research emphases on high boiling point compounds and simulating the donned glove environment

2020-03-25

This second part of the review of the 21st century literature on glove permeation is divided into the following major themes; permeation data and mathematical models, exposure/risk assessment, and manufacturer data. The major issues in the literature were the demonstrations that increasing temperature and applying forces increased permeation; and that glove manufacturer data were sometimes not reproducible. Double gloving of disposable gloves was found to be effective in resisting chemical permeation for short periods of time. Harmonization of standards and commercial glove classifications were called for at conditions that were closer to the temperature and applied forces actually present in the workplace, including whole glove testing and quantitative rather than just qualitative criteria. More research was recommended in each section and subsection with particular emphasis on defining the efficiency of solid phase collection devices, and more data in areas like exposure to cosmetics, household products, liquid foods, drinks, and cleaning liquids. More research in exposure assessment for permeated chemicals with sensors on the inner glove surface and on the skin was called for. Finally, it was decided that the state of the art of current practice was in a situation that needed the permeation standards, research, and the permeation charts of glove manufacturers to be at conditions that better reflected those encountered by workers with donned gloves.

Authors: Banaee S, Que Hee SS

Full Source: Journal of occupational and environmental hygiene. 2020 Apr;17(4):135-164. doi: 10.1080/15459624.2020.1721509. Epub 2020 Mar 25.

Double gloving of disposable gloves was found to be effective in resisting chemical permeation for short periods of time.

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Acidic seawater improved 5-hydroxymethylfurfural yield from sugarcane bagasse under microwave hydrothermal liquefaction

2020-03-06

5-Hydroxymethylfurfural (HMF) as value-added platform chemical can be derived from biomass. This study used microwave hydrothermal liquefaction (MHTL) to obtain HMF from sugarcane bagasse in acidic seawater conditions. The key processing parameters including temperature, reaction time, and liquid-to-solid ratio (L/S) were evaluated and optimized. The highest HMF yield of 8.1 wt% was obtained at 149 °C with a reaction time of 4 min and a L/S value of 12:1, respectively. This yield is considerable and even higher than the yield derived from sugarcane molasses under similar microwave conditions in the absence of seawater. Hence, acidic seawater was found to promote the hydrolysis of sugarcane bagasse to give HMF precursor (i.e. fructose and glucose), while simultaneously inhibiting the conversion of HMF to levulinic acid under MHTL conditions, possibly explaining the high HMF yield. This method presents a new and sustainable means of transforming waste biomass to valuable substances using seawater or brine wastewater.

Authors: Shao Y, Tsang DCW, Shen D, Zhou Y, Jin Z, Zhou D, Lu W, Long Y
Full Source: Environmental research. 2020 May;184:109340. doi: 10.1016/j.envres.2020.109340. Epub 2020 Mar 6.

Functionality of a next generation biosynthetic bacterial 6-phytase in enhancing phosphorus availability to weaned piglets fed a corn-soybean meal-based diet without added inorganic phosphate

2020-03-01

The utility of a next generation biosynthetic bacterial 6-phytase (PhyG) in restoring bone ash, bone phosphorus (P) content and performance in piglets depleted in P was evaluated. A total of 9 treatments were tested as follows. Treatment 1, a negative control (NC) diet; treatments 2, 3, 4, NC supplemented with 250, 500 or 1,000 FTU/kg of PhyG; treatments 5, 6, NC supplemented with 500 or 1,000 FTU/kg of a commercial *Buttiauxella* sp phytase (PhyB); treatments 7, 8, 9, NC supplemented with monocalcium phosphate (MCP) to provide 0.7, 1.4 and 1.8 g/kg digestible P, equating to a digestible P content of 1.8, 2.5 and 2.9 g/kg. The latter constituting the positive control (PC) diet with adequate P and calcium (Ca). The NC was formulated without inorganic P (1.1 g digestible P/kg) and reduced in Ca (5.0 g/kg). Additional limestone was added to treatments 7 to 9

This study used microwave hydrothermal liquefaction (MHTL) to obtain HMF from sugarcane bagasse in acidic seawater conditions.

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to maintain Ca-to-P ratio between 1.2 and 1.3. A total of 162 crossed Pietrain × (Large White × Landrace) 21-d-old piglets (50% males and 50% females) were fed adaptation diets until 42 d old and then assigned to pens with 2 pigs/pen and 9 pens/treatment in a completely randomized block design. Piglets were fed mash diets based on corn and soybean meal ad libitum for 28 d. At the end of the study, one piglet per pen was euthanized and the right feet collected for determination of bone strength, bone ash and mineral content. Compared with the PC, the NC group had reduced average daily gain (ADG) and increased feed conversion ratio (FCR) during all growth phases and overall, and at d 28 (70 d old) NC pigs had bones with reduced ash, Ca and P content ($P < 0.05$). The PhyG at 250 FTU/kg improved bone ash vs. NC. Increasing PhyG dose linearly or quadratically improved bone ash, ADG and FCR ($P < 0.05$). At ≥ 500 FTU/kg, both PhyG and PhyB maintained ADG and FCR equivalent to PC. Linear regression analysis was done to compare the measured response parameters to increasing digestible P from MCP. Based on this analysis it was shown that PhyG and PhyB at 1,000 FTU/kg could replace 1.83 and 1.66 g/kg digestible P from MCP in the diet, respectively, on average across metacarpi bone ash, ADG or FCR. These findings suggest that the biosynthetic phytase is highly effective in the tested dietary setting.

Authors: Dersjant-Li Y, Villca B, Sewalt V, de Kreij A, Marchal L, Velayudhan DE, Sorg RA, Christensen T, Mejdal R, Nikolaev I, Pricelius S, Kim HS, Haaning S, Sørensen JF, Lizardo R
Full Source: Animal nutrition (Zhongguo xu mu shou yi xue hui)

A wide range of marine organisms ingest plastic, and its impacts are of growing concern

ENVIRONMENTAL RESEARCH

In vivo accumulation of plastic-derived chemicals into seabird tissues

2020-02-24

Plastic debris is ubiquitous and increasing in the marine environment [1]. A wide range of marine organisms ingest plastic, and its impacts are of growing concern [2]. Seabirds are particularly susceptible to plastic pollution because of high rates of ingestion [3]. Because marine plastics contain an array of hazardous compounds, the chemical impacts of ingestion are concerning. Several studies on wild seabirds suggested accumulation of plastic-derived chemicals in seabird tissues [4-7]. However, to date, the evidence has all been indirect [4-7], and it is unclear whether plastic debris is the source of these pollutants. To obtain direct evidence for the transfer and accumulation of plastic additives in the

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tissues of seabirds, we conducted an in vivo plastic feeding experiment. Environmentally relevant exposure of plastics compounded with one flame retardant and four ultraviolet stabilizers to streaked shearwater (*Calonectris leucomelas*) chicks in semi-field conditions resulted in the accumulation of the additives in liver and adipose fat of 91 to 120,000 times the rate from the natural diet. Additional monitoring of six seabird species detected these chemical additives only in those species with high plastic ingestion rates, suggesting that plastic debris can be a major pathway of chemical pollutants into seabirds. These findings provide direct evidence of seabird exposure to plastic additives and emphasize the role of marine debris ingestion as a source of chemical pollution in marine organisms.

Authors: Tanaka K, Watanuki Y, Takada H, Ishizuka M, Yamashita R, Kazama M, Hiki N, Kashiwada F, Mizukawa K, Mizukawa H, Hyrenbach D, Hester M, Ikenaka Y, Nakayama SMM

Full Source: *Current Biology*: CB. 2020 Feb 24;30(4):723-728.e3. doi: 10.1016/j.cub.2019.12.037. Epub 2020 Jan 30.

Environmental health research in Africa: important progress and promising opportunities

2020-01-16

The World Health Organization in 2016 estimated that over 20% of the global disease burden and deaths were attributed to modifiable environmental factors. However, data clearly characterizing the impact of environmental exposures and health endpoints in African populations is limited. To describe recent progress and identify important research gaps, we reviewed literature on environmental health research in African populations over the last decade, as well as research incorporating both genomic and environmental factors. We queried PubMed for peer-reviewed research articles, reviews, or books examining environmental exposures and health outcomes in human populations in Africa. Searches utilized medical subheading (MeSH) terms for environmental exposure categories listed in the March 2018 US National Report on Human Exposure to Environmental Chemicals, which includes chemicals with worldwide distributions. Our search strategy retrieved 540 relevant publications, with studies evaluating health impacts of ambient air pollution (n=105), indoor air pollution (n = 166), heavy metals (n = 130), pesticides (n = 95), dietary mold (n = 61), indoor mold (n = 9), per- and polyfluoroalkyl substances (PFASs, n = 0), electronic waste (n = 9), environmental phenols (n = 4), flame retardants (n = 8), and phthalates (n = 3), where publications could belong to more than one exposure

However, data clearly characterizing the impact of environmental exposures and health endpoints in African populations is limited.

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category. Only 23 publications characterized both environmental and genomic risk factors. Cardiovascular and respiratory health endpoints impacted by air pollution were comparable to observations in other countries. Air pollution exposures unique to Africa and some other resource limited settings were dust and specific occupational exposures. Literature describing harmful health effects of metals, pesticides, and dietary mold represented a context unique to Africa. Studies of exposures to phthalates, PFASs, phenols, and flame retardants were very limited. These results underscore the need for further focus on current and emerging environmental and chemical health risks as well as better integration of genomic and environmental factors in African research studies. Environmental exposures with distinct routes of exposure, unique co-exposures and co-morbidities, combined with the extensive genomic diversity in Africa may lead to the identification of novel mechanisms underlying complex disease and promising potential for translation to global public health.

~sAuthors: Joubert BR, Mantooth SN, McAllister KA

Full Source: *Frontiers in genetics*. 2020 Jan 16;10:1166. doi: 10.3389/fgene.2019.01166. eCollection 2019.

Effects of diluted bitumen exposure and recovery on the seawater acclimation response of Atlantic salmon smolts.

2020-01-20

Petrogenic chemicals are common and widespread contaminants in the aquatic environment. In Canada, increased extraction of bitumen from the oil sands and transport of the major crude oil export product, diluted bitumen (dilbit), amplifies the risk of a spill and contamination of Canadian waterways. Fish exposed to sublethal concentrations of crude oil can experience a variety of adverse physiological effects including osmoregulatory dysfunction. As regulation of water and ion balance is crucial during the seawater transition of anadromous fish, the hypothesis that dilbit impairs seawater acclimation in Atlantic salmon smolts (a fish at risk of exposure in Canada) was tested. Smolts were exposed for 24 d to the water-soluble fraction of dilbit in freshwater, and then transferred directly to seawater or allowed a 1 wk depuration period in uncontaminated freshwater prior to seawater transfer. The seawater acclimation response was quantified at 1 and 7 d post-transfer using established hematological, tissue, and molecular endpoints including gill Na⁺/K⁺-ATPase gene expression (nka). All smolts, irrespective of dilbit exposure, increased serum Na⁺ concentrations and osmolality within 1 d of seawater transfer. The recovery of these parameters to freshwater

Fish exposed to sublethal concentrations of crude oil can experience a variety of adverse physiological effects including osmoregulatory dysfunction

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values by 7 d post-transfer was likely driven by the increased expression and activity of Na⁺/K⁺-ATPase in the gill. Histopathological changes in the gill were not observed; however, CYP1A-like immunoreactivity was detected in the pillar cells of gill lamellae of fish exposed to 67.9 µg/L PAC. Concentration-specific changes in kidney expression of a transmembrane water channel, aquaporin 3, occurred during seawater acclimation, but were resolved with 1 wk of depuration and were not associated with histopathological changes. In conclusion, apart from a robust CYP response in the gill, dilbit exposure did not greatly impact common measures of seawater acclimation, suggesting that significant osmoregulatory dysfunction is unlikely to occur if Atlantic salmon smolts are exposed sub-chronically to dilbit.

Authors: Alderman SL, Dillkumar CM, Avey SR, Farrell Ap, Kennedy CJ, Gillis TE

Full Source: Aquatic Toxicology (Amsterdam, Netherlands). 2020 Apr;221:105419. doi: 10.1016/j.aquatox.2020.105419. Epub 2020 Jan 20.

Accumulation and ecological risk of heavy metals in soils along the coastal areas of the Bohai Sea and the Yellow Sea: A comparative study of China and South Korea.

2020-01-31

Soils in coastal areas of the land-sea interface are vulnerable to heavy metal (HM) accumulation and subsequently to human health risk. However, few studies have investigated the HM pollution and risk in soils along the coastal areas of the Yellow Sea Large Marine Ecosystem (YSLME), in an international perspective. This study is the first comprehensive work in the YSLME encompassing 122 coastal locations along the Bohai Sea (BS), Yellow Sea of China (YSC), and Yellow Sea of South Korea (YSK). Soil HM pollution showed great spatial variations cross the regions and countries. Accumulations of As, Cu, Pb, and Zn in the YSK were significantly higher than those in the BS and YSC ($p < 0.05$). Whilst the elevated Cd, Hg, and Ni in soils were found in the BS and YSC compared to those in the YSK ($p < 0.05$). Meantime, the assessment of ecological risk posed by HMs indicated higher potential risk in the BS than other coastal areas. In specific, Cd and Hg posed a higher risk in the BS and YSC, while As showed relatively high risk in the YSK, indicating site-dependent accumulation of HMs in soils. Soil pH and organic matter were found to be important factors affecting the HM accumulation in the study areas. Industrial activities are the major driving factors influencing spatial distributions of HMs, and such activities exhibited different degrees of influence across the sampling sites. Altogether, the results of present study first identified the

This study is the first comprehensive work in the YSLME encompassing 122 coastal locations along the Bohai Sea (BS), Yellow Sea of China (YSC), and Yellow Sea of South Korea (YSK).

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bilateral characteristics of soil HM pollution along the entire coasts of the YSLME in a comprehensive manner in several aspects: (1) sources, (2) hot spots, (3) priority chemicals of concern, and (4) site-specific potential risk of the soil HMs. Overall, this study provides references and backgrounds for future environmental management strategies and aids in developing a bilateral government policy towards coastal pollution management of HMs from an international scale and perspective.

Authors: Liu P, Hu W, Tian K, Huang B, Zhao Y, Wang X, Zhou Y, Shi B, Kwon BO, Choi K, Ryu J, Chen Y, Wang T, Khim JS

Full Source: Environment International. 2020 Apr;137:105519. doi: 10.1016/j.envint.2020.105519. Epub 2020 Jan 31.

Correlates of plasma concentrations of brominated flame retardants in a cohort of U.S. Black women residing in the Detroit, Michigan metropolitan area.

2020-04-20

BACKGROUND:

Polybrominated diphenyl ethers (PBDEs) and polybrominated biphenyls (PBBs) are brominated flame retardant chemicals detectable in the environment and U.S. population, and are associated with adverse health outcomes over the life course. Correlates of these organic pollutants are understudied among U.S. Black women.

METHODS:

Using baseline data from a prospective cohort study of U.S. Black women aged 23-35 years from the Detroit area of Michigan (2010-2012), we examined correlates of PBDEs and PBB-153. Non-fasting blood samples were collected from 742 participants at enrollment, a subset of women selected for a case-cohort study of environmental chemicals. Data on socio-demographics, behaviors, diet, medical history, and early-life exposures were collected via self-administered questionnaires, telephone interviews, and in-person clinic visits. We fit linear regression models to calculate percent differences and 95% confidence intervals in lipid adjusted plasma concentrations of 11 individual PBDE congeners and PBB-153 for each baseline predictor.

RESULTS:

In models adjusted for all other correlates, a 5-year increase in age was inversely associated with most PBDE congeners (% differences ranged from 6 to 15% lower), and was positively associated with PBB-153 (52% higher). A 5-kg/m² increase in BMI was inversely associated with PBDE-153 and PBB-153 (16% lower for both), and 6% higher for PBDE-28. Compared with having never been breastfed in infancy, ≥3 months of breastfeeding

Correlates of these organic pollutants are understudied among U.S. Black women.

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in infancy was associated with 69% higher PBB-153 concentrations. Lower education, current smoking, and heavy alcohol use were associated with higher plasma concentrations of most flame retardants. Diet was not an important predictor.

CONCLUSION:

Important correlates for elevated body burdens of PBB-153 were increasing age and a history of having been breastfed in infancy. Education, smoking, and heavy alcohol use were important predictors of elevated body burdens of most flame retardants. This study fills an important gap in the environmental health literature by focusing on an understudied population.

Authors: Orta OR, Wesselink AK, Bethea TN, Claus Henn B, McClean MD, Sjödin A, Baird DD, Wise LA

Full Source: Science of the total environment. 2020 Apr 20;714:136777. doi: 10.1016/j.scitotenv.2020.136777. Epub 2020 Jan 18.

OCCUPATIONAL

Assessment of respiratory problems in workers associated with intensive poultry facilities in Pakistan

2020-03-01

BACKGROUND:

The poultry industry in Pakistan has flourished since the 1960s; however, there are scarce data regarding the impact of occupational exposure on the pulmonary health of farm workers in terms of years working in the industry. The objective of the present study was to assess the effect of poultry environment on the health of occupationally exposed poultry farmers in countries of warm climatic regions, such as Pakistan. This study will also show the effect of exposure to poultry facilities on the health of poultry farmers in the context of low-income countries with a relatively inadequate occupational exposure risk management.

MATERIALS AND METHODS:

The lung function capacity of 79 poultry workers was measured using a spirometer. Along with spirometry, a structured questionnaire was also administered to obtain information about age, height, weight, smokers/nonsmokers, years of working experience, and pulmonary health of farm workers. The workers who were directly involved in the care and handling of birds in these intensive facilities were considered and divided into four groups based on their years of working experience: Group I (3-10 months), Group II (1-5 years), Group III (6-10 years), and Group IV (more than 11 years). The forced vital capacity (FVC), forced expiratory volume

Based on the performed spirometry, 68 (86 %) of workers were found normal and healthy, whereas 11 (14 %) had a mild obstruction.

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in one second (FEV1) and the FEV1/FVC ratio were considered to identify lung function abnormalities. Statistical analysis was carried out using independent sample t test, Chi-square test, Pearson's correlation, and linear regression.

RESULTS:

Based on the performed spirometry, 68 (86 %) of workers were found normal and healthy, whereas 11 (14 %) had a mild obstruction. Of the 11 workers with mild obstruction, the highest number with respect to the total was in Group IV (more than 11 years of working experience) followed by Group III and Group II. Most of the workers were found healthy, which seems to be because of the healthy survivor effect. For the independent sample t test, a significant difference was noticed between healthy and nonhealthy farmers, whereas Chi-square test showed a significant association with height, drugs, and working experience. Linear regression that was stratified by respiratory symptoms showed for workers with symptoms, regression models for all spirometric parameters (FVC, FEV1, and FEV1/FVC) have better predictive power or R square value than those of workers without symptoms.

CONCLUSION:

These findings suggest that lung function capacity was directly related to years of working experience. With increasing number of working years, symptoms of various respiratory problems enhanced in the poultry workers. It should be noted that most of the poultry workers were healthy and young, the rationale being that there is a high turnover rate in this profession. The mobility in this job and our finding of 86% of the healthy workers in the present study also proposed healthy worker survivor effect.

Authors: Yasmeeen R, Ali Z, Tyrrel S, Nasir ZA

Full Source: Safety and health at work. 2020 Mar;11(1):118-124. doi: 10.1016/j.shaw.2019.12.011. Epub 2020 Jan 7.

Exposures and urinary biomonitoring of aliphatic isocyanates in construction metal structure coating

2020-02-28

BACKGROUND:

Isocyanates are highly reactive chemicals used widely in metal structure coating applications in construction. Isocyanates are potent respiratory and skin sensitizers and a leading cause of occupational asthma. At present, there is no cure for isocyanate asthma and no biomarkers of early disease. Exposure reduction is considered the most effective preventive strategy. To date, limited data are available on isocyanate exposures and

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work practices in construction trades using isocyanates, including metal structure coatings.

OBJECTIVES:

The primary objectives of this work were: i) to characterize isocyanate inhalation and dermal exposures among painters during metal structure coating tasks in construction; and ii) to assess the adequacy of existing work practices and exposure controls via urinary biomonitoring pre- and post-shift.

METHODS:

Exposures to aliphatic isocyanates based on 1,6-hexamethylene diisocyanate (1,6-HDI) and its higher oligomers (biuret, isocyanurate and uretdione) were measured among 30 workers performing painting of bridges and other metal structures in several construction sites in the Northeastern USA. Exposure assessment included simultaneous measurement of personal inhalation exposures (n = 20), dermal exposures (n = 22) and body burden via urinary biomonitoring pre- and post-shift (n = 53). Contextual information was collected about tasks, processes, materials, work practices, personal protective equipment (PPEs) and exposure controls, work histories, and environmental conditions.

RESULTS:

Breathing zone concentrations were the highest for biuret (median, 18.4 $\mu\text{g}/\text{m}^3$), followed by 1,6-HDI monomer (median, 3.5 $\mu\text{g}/\text{m}^3$), isocyanurate (median, 3.4 $\mu\text{g}/\text{m}^3$) and uretdione (median, 1.7 $\mu\text{g}/\text{m}^3$). The highest exposures, measured during painting inside an enclosed bridge on a hot summer day, were: 10,288 $\mu\text{g}/\text{m}^3$ uretdione; 8,240 $\mu\text{g}/\text{m}^3$ biuret; and 947 $\mu\text{g}/\text{m}^3$ 1,6-HDI. Twenty percent of samples were above the NIOSH ceiling exposure limit for 1,6- HDI (140 $\mu\text{g}/\text{m}^3$) and 35% of samples were above the UK-HSE ceiling for total isocyanate group (70 $\mu\text{g NCO}/\text{m}^3$). Isocyanate loading on the gloves was generally high, with a median of 129 μg biuret/pair and maximum of 60.8 mg biuret/pair. The most frequently used PPEs in the workplace were half-face organic vapor cartridge (OVC) respirators, disposable palmar dip-coated polymer gloves, and cotton coveralls. However, 32% of workers didn't wear any respirator, 47% wore standard clothing with short-sleeve shirts and 14% didn't wear any gloves while performing tasks involving isocyanates. Based on biomonitoring results, 58.4% of urine samples exceeded the biological monitoring guidance value (BMGV) of 1 μmol hexamethylene diamine (HDA)/mol creatinine. Post-shift geometric mean HDA normalized to specific gravity increased by 2.5-fold compared to pre-shift (GM, 4.7 vs. 1.9 ng/mL; p value, < 0.001), and only 1.4-fold when normalized to creatinine.

CONCLUSIONS:

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Exposure and biomonitoring results, coupled with field observations, support the overall conclusions that (i) substantial inhalation and dermal exposures to aliphatic isocyanates occur during industrial coating applications in construction trades; that (ii) the current work practices and exposure controls are not adequately protective. High urinary creatinine values in the majority of workers, coupled with significant cross-shift increases and field observations, point to the need for further investigations on possible combined effects of heat stress, dehydration, and nutritional deficiencies on kidney toxicity. Implementation of comprehensive exposure control programs and increased awareness are warranted in order to reduce isocyanate exposures and associated health risks among this cohort of construction workers.

Authors: Bello A, Xue Y, Gore R, Woskie S, Bello D

Full Source: International journal of hygiene and environmental health. 2020 Feb 28;226:113495. doi: 10.1016/j.ijheh.2020.113495. [Epub ahead of print]

Gasoline vapor emissions during vehicle refuelling events in a vehicle fleet saturated with onboard refuelling vapor recovery systems: need for an exposure assessment

2020-02-07

Background: Gasoline contains large proportions of harmful chemicals, which can be released during vehicle refueling. Onboard Refueling Vapor Recovery (ORVR) can reduce these emissions, but there is limited research on the system's efficacy over time in an actual vehicle fleet. The aims of this study are: (1) determine the feasibility of using an infrared camera to view vapor emissions from refueling; (2) examine the magnitude of refueling-related emissions in an ORVR-saturated fleet, to determine need for an exposure-assessment.

Methods: Using an infrared camera optimized for optical gas imaging of volatile organic chemicals, refueling was recorded for 16 vehicles at six gas stations. Pumps were inspected for damage, refueling shut-off valve functioning, and presence of Stage II Vapor Recovery. Vehicle make/model and age were recorded or estimated.

Results: Vapor emissions were observed for 14 of 16 vehicles at each station, with severity varying substantially by vehicle make/model and age. Use of an infrared camera allowed for identification of vapor sources and timing of release, and for visualizing vapor trajectories.

Discussion: Notably emissions occurred not only at the beginning and end of refueling but also throughout, in contrast to a prior study which did not detect increases in atmospheric hydrocarbon levels mid-refueling.

Onboard Refueling Vapor Recovery (ORVR) can reduce these emissions, but there is limited research on the system's efficacy over time in an actual vehicle fleet.

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Future studies are vitally needed to determine the risk to individuals during typical refueling in an ORVR saturated vehicle fleet. We recommend comprehensive exposure-assessment including real-time monitoring of emitted volatile organic compounds paired with infrared gas-imaging and measurement of internal dose and health effects of gas station customers.~sAuthors: Shearston JA, Hilpert M

Full Source: *Frontiers in public health*. 2020 Feb 7;8:18. doi: 10.3389/fpubh.2020.00018. eCollection 2020.

A framework to model exposure to per-and polyfluoroalkyl substances in indoor environments

2020-03-01

Per- and polyfluoroalkyl substances (PFAS) include a wide range of halogenated chemicals, which have been used as water- and stain-resistant coatings for consumer products and industrial purposes. PFAS are persistent in the environment and several are bioaccumulative, and thus relevant for human and environmental health. Given their pervasiveness, we need to understand how we are exposed to PFAS, especially in indoor environments where many people spend most of their time. Research on indoor exposure to semivolatile organic compounds (SVOCs) has progressed rapidly in recent years. Because many PFAS can be considered SVOCs, much of what has been learned about SVOCs may be used to guide research on PFAS exposure in indoor environments. Here, we briefly review what has been done to assess indoor exposure to PFAS. Then, we propose a systematic indoor exposure framework for PFAS based on methods to estimate exposure to SVOCs. We illustrate how critical parameters such as partition coefficients for different media (particles, dust, surfaces, and clothing) for different types of PFAS could be measured, how these measurements can be used in exposure models for PFAS, and how fundamental, predictive relationships might be used to estimate necessary parameters for emerging compounds.

Authors: Eichler CMA, Little JC

Full Source: *Environmental science. Processes and impacts*. 2020 Mar 1;22(3):500-511. doi: 10.1039/c9em00556k. Epub 2020 Mar 6.

PFAS are persistent in the environment and several are bioaccumulative, and thus relevant for human and environmental health.

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Measuring exposure of e-waste dismantlers in Dhaka Bangladesh to organophosphate esters and halogenated flame retardants using silicone wristbands and T-shirts

2020-02-20

Silicone (polydimethylsiloxane or PDMS) wristbands and cotton T-shirts were used to assess the exposure of e-waste recyclers in Dhaka, Bangladesh to polybrominated diphenyl ethers (PBDEs), novel brominated flame retardants (NBFRs), dechlorane plus (DPs), and organophosphate esters (OPEs). The median surface-normalized uptake rates of PBDEs, NBFRs, DPs, and OPEs were 170, 8.5, 4.8, and 270 ng/dm²/h for wristbands and 5.4, 2.0, 0.94, and 23 ng/dm²/h for T-shirts, respectively. Concentrations of Tris(2-chloroethyl) phosphate (TCEP), Tris(1,3-dichloro-2-propyl) phosphate (TDCIPP), Tri-m-cresyl phosphate (TmCP), Bis(2-ethylhexyl) tetrabromophthalate (BEH-TEBP), and Dechlorane plus (DPs) in wristbands were significantly correlated with those in T-shirts. Wristbands accumulated ~7 times more mass than T-shirts, especially of compounds expected to be mainly in the gas phase. We introduce the silicone "sandwich" method to approximate the easily releasable fraction (ERF) from T-shirts, hypothesized to be related to dermal exposure. ERFs varied from 6 to 75% of total chemical accumulated by T-shirts and were significantly negatively correlated with compounds' octanol-air partition coefficient (log K_{oa}). The median daily exposure doses via dermal transfer from the front of the T-shirt to the front body trunk were 0.32, 0.13, 0.11, and 9.1 ng/kg-BW/day for PBDEs, NBFRs, DPs, and OPEs, respectively. The evidence of e-waste recycler exposure to flame retardants in this low income country, lacking protective personal equipment, calls for measures to minimize their exposure and for chemical management regulations to consider exposures to chemicals in waste products.

Authors: Wang Y, Peris A, Rifat MR, Ahmed SI, Aich N, Nguyen LV, Urik J, Eljarrat E, Vrana B, Jantunen LM, Diamond ML

Full Source: *The science of the total environment*. 2020 Feb 20;720:137480. doi: 10.1016/j.scitotenv.2020.137480. [Epub ahead of print]